

DESIGN AND FABRICATE OF A MOTORIZED CUTTER FOR MECHANICAL PART

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SUPERVISOR'S DECLARATION

“I hereby declare that we have checked this project and in my opinion this project is satisfactory in terms of scope and quality for the award of the degree of Diploma of Mechanical Engineering”

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Date:

STUDENT'S DECLARATION

I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged. The thesis has not been accepted for any degree and is not concurrently submitted for award of other degree.

Signature:

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DEDICATION

To my parent, friends, without whom and his/her lifetime efforts, my pursuit of higher education would not have been possible and I would not have had the chance to study for a mechanical course

Also to my supervisor, Mr. Shahmi B. Junoh@Yacob and other Mechanical staff, without whose wise suggestions, helpful guidance and direct assistance, it could have neither got off the ground nor ever been completed.

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ABSTRACT

Cutter is a common tool used in various cutting shape for a variety purposes. In this project, the improvement of cutter which is design and fabricate of a motorized cutter for mechanical part then integrate the system using a 24V DC motor to operate the system so it can cut the fruit brunches easily without using our own energy too much. This cutter can lift up until 3.5 m and above according the user height and it not too heavy to carry it because it weight is 2.2 kg including the electro-mechanical part. This cutter also safe to used because of the C-sickle is weld properly and tied with aluminum plate together with bolt and nut so it cannot easily falling down to the ground which is can get hurt. The design of this product is suitable with the electro-mechanical part and can work together. The operating for this system is control by the controller to moving the motor spindle. When press the ON button the motor spindle will move clockwise direction then roll the rope while it attract top rod which is it will through the hole until the spring retract is finish. Then, when press the OFF button, the motor spindle will released the rope and the spring will extend back to it normal position. However, this cutter needs to be handled by two persons because one person needs to hold the battery and the controller and the other person will hold the rod. Hence, this motorized cutter can help people to harvesting fruit bunches easily and also can used it in a long term.

ABSTRAK

Pemotong ialah peralatan yang biasa digunakan dalam pelbagai jenis pemotongan dan juga mempunyai pelbagai kegunaan. Di dalam projek ini, saya membuat penambahbaikan pemotong iaitu reka bentuk dan membuat pemotong bermotor untuk bahagian mekanikal selepas itu akan digabungkan dengan menggunakan 24V DC motor untuk menjalankan sistem ini supaya ia akan dapat memotong tangkai buah dengan mudah tanpa mengeluarkan tenaga dengan banyak. Pemotong ini dapat diangkat ke atas sehingga 3.2 m dan ke atas mengikut ketinggian pengguna itu sendiri. Ia juga tidak terlalu berat untuk dibawa kerana mempunyai berat sebanyak 2.2 kg termasuk berat bahagian electro-mekanikal. Pemotong ini juga selamat digunakan kerana mata sabit C dikimpal dengan teliti bersama-sama kepingan aluminium dengan bolt dan nut supaya ia tidak mudah jatuh ke bawah lalu menyebabkan kecederaan. Reka bentuk untuk produk ini sesuai dengan bahagian electro-mekanikal dan dapat beroperasi dengan baik. Operasi sistem ini dikawal oleh alat kawalan untuk mengerakkan spindle motor. Apabila butang ON ditekan, spindle motor akan bergerak mengikut arah jam dan akan mengulung tali dimana pada masa yang sama tali itu akan menarik rod besi diatas dan melalui lubang yang ditebuk sehingga spring menarik sampai habis. Kemudian, apabila butang OFF ditekan, spindle motor akan meeraikan tali dan spring akan memanjang semula ke posisi asalnya. Walaubagaimanapun, pemotong ini perlu dikawal seramai dua orang kerana salah seorang perlu memegang rod pemotong. Dengan itu, pemotong bermotor ini dapat menolong pengguna untuk mencantas tangkai buah dengan mudah dan juga boleh digunakan dalam jangka masa yang panjang.

CONTENTS

CHAPTER	TITLE	PAGE
	SUPERVISOR DECLARATION	II
	STUDENT'S DECLARATION	III
	DEDICATION	IV
	ACKNOWLEDGEMENTS	V
	ABSTRACT	VI
	ABSTRAK	VII
	CONTENTS	VIII
	LIST OF TABLES	IX
	LIST OF FIGURES	X
1	INTRODUCTION	
	1.1 Overview	1
	1.2 Problem statement	2
	1.3 Importance of the project	3
	1.4 Scope of the project	3
	1.5 Project objective	4
	1.6 Project Planning	4
	1.7 Report outline	6
2	LITERATURE REVIEW	
	2.1 Introduction	7
	2.2 Type of Motorized Cutter	7
	2.3 Basic part	10
	2.4 Joining method	10
	2.4.1 Metal Inert Gas (MIG) welding	10

2.4.2 Mechanical Fasteners	13
2.5 Drilling	14
2.6 Vertical Band Sawing Machine	15
3 METHODOLOGY	
3.1 Introduction	17
3.1.1 Project Flow Chart	18
3.2 Design and sketching	20
3.2.1 Introduction	20
3.2.2 Design	20
3.2.3 Drawing	21
3.2.4 Design specification	21
3.2.5 Sketching drawing selection	22
3.2.5.1 Finalized design	24
3.2.6 Solidwork design drawing	25
3.2.7 Overall view of the design	25
3.2.7.1 Design description	25
3.2.7.2 Materials	27
3.2.7.3 Functional performance	28
3.2.7.4 Speciality	28
3.3 Fabrication process	28
3.3.1 Introduction	28
3.3.2 List of process	29
3.3.3 Fabrication procedure	29
4 RESULT & DISCUSSION	
4.1 Finishing product	36
4.2 Specification	37
4.3 Testing the product	37
4.4 Discussion	38

5	CONCLUSION & RECOMMENDATION	
5.1	Introduction	39
5.2	Project problem	39
5.3	Recommendation	40
5.4	Conclusion	40
	REFERENCES	41
	APPENDICES	
A	Component of Motorized Cutter	42

LIST OF FIGURES

Figure no.		Page
1.1	Traditional cutter	2
2.1	Pole Pruner Cutter	8
2.2	Fiskars Pruner Cutter	8
2.3	Scissor Pole Cutter	9
2.4	Saw pole	9
2.5	Schematic of MIG welding	10
2.6	A GMAW wire feed unit	11
2.7	Basic component used in MIG welding	11
2.8	GMAW torch nozzle	12
2.9	Mechanical fasteners	13
2.10	Drilling	15
2.11	Vertical bandsawing machine	16
3.1	Project flow chart	18
3.2	Sketching 1	22
3.3	Sketching 2	22
3.4	Sketching 3	23
3.5	Sketching 4	23
3.6	Finalized design	24
3.7	Isometric view	26
3.8	Measuring process	32
3.9	Cutting process 1	32
3.10	Cutting process 2	32
3.11	Grinding process	33
3.12	Drilling process	33
3.13	Joining process 1	34
3.14	Joining process 2	34

3.15	Bending process	34
3.16	Spraying process	35
3.17	Integration system	35
4.1	Finishing Motorized cutter	36
4.2	Testing the Motorized utter	37
4.3	Testing another tree	38

CHAPTER 1

INTRODUCTION

1.1 Overview

This project presents a design and development of a Motorized Cutter (Mechanical Part) that considers strength, durability, light in weight, easy to use and safe, save time and ergonomic factor. This cutter would be entirely different from existing cutters. The Diploma final year project allocates the duration of one semester, this large man-hour project requires significant efforts of the student to participate. Basically the entire Motorized Cutter project could be divided into three stages, which are concept review and development, designing and fabrication.

The Motorized Cutter is equipped by using all necessary items and methods for instance hollow pipe steel, black hollow steel, rectangular hollow steel, aluminum, spring, skills in manufacturing processes metal inert gas (MIG) welding to join the parts, drilling and also mechanical fasteners. The advantages of the proposed cutter to be developed can be seen that it can be harvesting fruit about 3.5 m height not included human height and at the same time this cutter is powered by 24V DC motor to control the movement of the spring that can extend and retract so the c-sickle easy to cut the fruits brunches.

The process of development is initiated from conceptual design stage by considering the function as well simplicity. In order to make friendly environmental-cutter, the ergonomic factor is also taken into account. Practical development involves the measurement, cutting the materials into required size and shape and assembly.

1.2 Problem Statement

People usually used a lot of energy when using the traditional cutter to harvesting fruits brunches or pruning fronds because some of the rod cutters made from heavy materials and took a long time to harvesting fruits. Have higher possibility for getting hurt because of the unsafe condition during harvesting fruits manually which is the blade peel easily fall down to ground when it unstable cutting the fruit brunches for a long time. It also easy to break and cannot used for a long term.



Figure 1.1: Traditional cutter

It is important to further improve the current design of Motorized Cutter (Mechanical Part), so that it more efficient to use.

1.3 Importance of The Project

The project leads the student understand how to use the knowledge and skill gathered before in solving problem. This project also promotes the student about capability of research, data gathering, analysis and then solving problem scientifically.

The project also will educate the student in communication like in a presentation and to defend their research in the presentation. The project also will generate students that have capability to make a good research report in thesis form or technical writing. This project also can produce and train student to capable of doing work with minimal supervisory and more independent in searching, detailing and expanding the knowledge and experiences.

1.4 Scope of The Project

- i) Doing literature review about the cutter in the current market.
- ii) Design the cutter according the sketching idea and then finalized the idea.
- iii) Material considered
 - Hollow pipe steel
 - Black hollow steel
 - Spring
 - Rectangular hollow steel
 - Aluminum
 - Bolt and nut
 - C-sickle
- iv) Fabricate the cutter according the schedule.
- v) Integrate the system between the mechanical part of motorized cutter and the electro-mechanical part.

1.5 Project Objectives

The objectives of the project are:

- To design the mechanical part of a Motorized Cutter and to fabricate the mechanical of the system.

1.6 Project Planning

The project begins with meeting the supervisor every week to define or discuss about the project. Then, do literatures review via internet, books, supervisor, and other relevant academic material that related to the title. The literature review is carried out through the project to keep up with the new knowledge about the current motorized cutter in the market.

At the same week schedule management is done using Microsoft Office. This takes a week to accomplish. Gantt chart is shown in figure 1.1.

Then, start with the sketching idea after that choose the best idea and finalized it. The selected idea is then transfer into solid modeling and engineering using Solidwork software.

The next task is preparation of progress presentation and report writing; both of these tasks take two week to be done. Before the midterm presentation and submit the report, I have prepared a speech for the presentation and double checked the report if it has mistakes.

Using the finalized drawing and sketching as references for the measurement and the materials needed. The fabrication process is schedule to takes on September and take about six weeks that include integrate the system, spraying and finishing.

Next task is the final report writing and final presentation preparation. This take about two weeks to accomplished. The report is guided by UMP Thesis writing guided and also the guidance from my supervisor. All the task is schedule to take about sixteen weeks overall.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A motorized cutter that operates at a motor speed and a control circuit that senses the motor speed and provides power to said motorized cutter at a level that corresponds to the motor speed, wherein more power is provided to said motorized cutter with a decrease in the motor speed.

The motorized cutter design is according to the present market demand and to fulfill criteria customers needs. It should be designed to crest a product in the market so that it will more quality and innovative.

2.2 Type of Cutter

Several Motorized Cutter with various function have been found.

i) Pole Pruner Cutter (Figure 2.1)

Advantage – Used 5 pulley systems that can provide 30% more power and total rope control.

Disadvantage – Have to change the rope if it breaking.



Figure 2.1: Pole Pruner Cutter

ii) Fiskars Pruner Cutter^[6] (Figure 2.2)

Advantage – Made from fiber glass and can extend until 12 feet.

Disadvantage – Only cut limited size of bunches.



Figure 2.2: Fiskars Pruner Cutter

iii) Scissor Pole Cutter (Figure 2.3)

Advantage – Ultimate cutting height from the ground of most other types hedging without leaving the ground.

Disadvantage – The cutter is too light.



Figure 2.3: Scissor Pole Cutter

iv) Saw Pole ^[8] (Figure 2.4)

Advantage – Specially designed sickle (C-sickle pattern) and support with saw cutting blade.

Disadvantage – Took a few minute to get fresh fruit bunches.



Figure 2.4: Saw Pole

2.3 Basic Part

Basically, there are two parts in Motorized Cutter design, C-sickle and body.

- i) C-sickle; is usually made from steel plate and sharp also designed in almost C shape to give higher cutting efficiency.
- ii) Body; have hollow pipe steel, spring so it can extend and retract, black hollow steel to support the spring and the rod

2.4 Joining Method

Joining involves in assembly stage. Commonly used method to join metal part is Metal Inert Gas (MIG) welding.

2.4.1 Metal Inert Gas (MIG) Welding

Figure 2.4 illustrated schematic of MIG method: An arc is struck between a consumable electrode and the sheet metal to be welded. The consumable electrode is in the form of continuous filler metal. An inert gas surrounds the arc and shields it from the ambient to prevent oxidation. Carbon steels, low alloys steels, stainless steels, most aluminum alloys, zinc based copper alloys can be welded using this process.

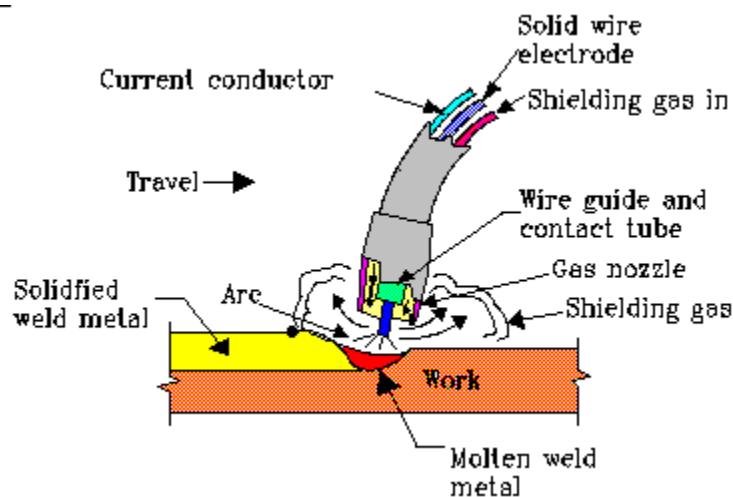


Figure 2.5: Schematic of Metal Inert Gas (MIG) welding



Figure 2.6: A GMAW wire feed unit

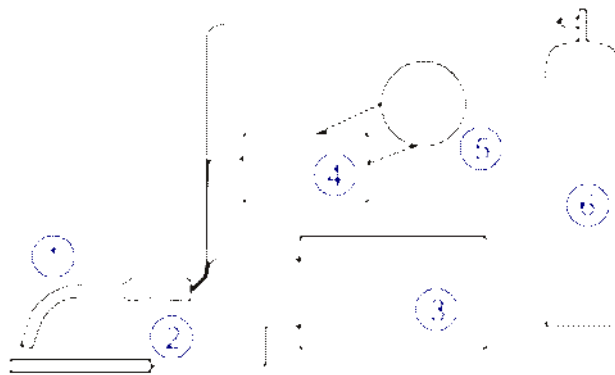


Figure 2.7: Basic component used in MIG operations

- i. Gun
- ii. Workpiece
- iii. Welding machine
- iv. Control system
- v. Wire
- vi. Shielding-gas source

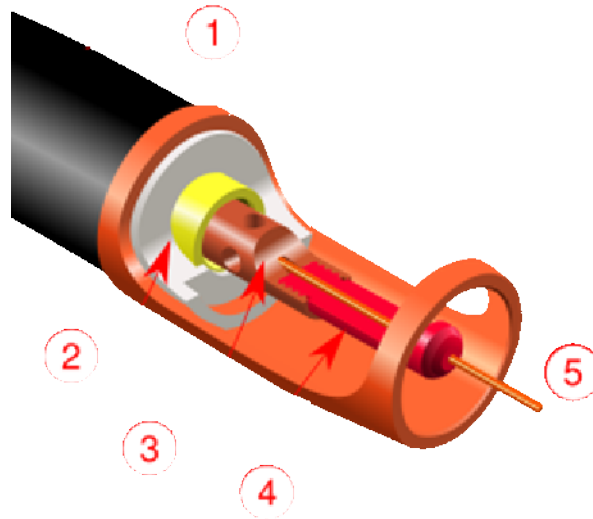


Figure 2.8: GMAW torch nozzle cutaway image. (1) Torch handle, (2) Molded phenolic dielectric (shown in white) and threaded metal nut insert (yellow), (3) Shielding gas nozzle, (4) Contact tip, (5) Nozzle output face

MIG (Metal Inert Gas) or as it even is called GMAW (Gas Metal Arc Welding) uses an aluminum alloy wire as a combined electrode and filler material. The filler metal is added continuously and welding without filler-material is therefore not possible. Since all welding parameters are controlled by the welding machine, the process is also called semi-automatic welding.

The MIG-process uses a direct current power source, with the electrode positive (DC, EP). By using a positive electrode, the oxide layer is efficiently removed from the aluminum surface, which is essential for avoiding lack of fusion and oxide inclusions. The metal is transferred from the filler wire to the weld bead by magnetic forces as small droplets, spray transfer. This gives a deep penetration capability of the process and makes it possible to weld in all positions. It is important for the quality of the weld that the spray transfer is obtained.

There is a different MIG-welding process, conventional MIG and pulsed MIG:

1) Conventional MIG uses a constant voltage DC power source. Since the spray transfer is limited to a certain range of arc current, the conventional MIG process has a lower